L 12

```
   SSSSSSSSSSSS  YYY         YYY     SSSSSSSSSSSS
   SSSSSSSSSSSS  YYY         YYY     SSSSSSSSSSSS
   SSSSSSSSSSSS  YYY         YYY     SSSSSSSSSSSS
SSS              YYY         YYY  SSS
SSS              YYY         YYY  SSS
SSS              YYY         YYY  SSS
SSS                 YYY   YYY     SSS
SSS                 YYY   YYY     SSS
SSS                 YYY   YYY     SSS
   SSSSSSSSS           YYY           SSSSSSSSS
   SSSSSSSSS           YYY           SSSSSSSSS
   SSSSSSSSS           YYY           SSSSSSSSS
            SSS        YYY                    SSS
            SSS        YYY                    SSS
            SSS        YYY                    SSS
            SSS        YYY                    SSS
            SSS        YYY                    SSS
            SSS        YYY                    SSS
SSSSSSSSSSSS           YYY        SSSSSSSSSSSS
SSSSSSSSSSSS           YYY        SSSSSSSSSSSS
SSSSSSSSSSSS           YYY        SSSSSSSSSSSS
```

```
_$

Ps
--
YZ

Z$

Z$

Z$


Z$


Z$





Z$

Z$

Z$

Z$

Z$

Z$


Z$
```

```
                                D 16
**FILE**ID**SYSUPDSEC

  SSSSSSSS  YY      YY    SSSSSSSS  UU      UU  PPPPPPPP    DDDDDDDD      SSSSSSSS  EEEEEEEEEE    CCCCCCCC
  SSSSSSSS  YY      YY    SSSSSSSS  UU      UU  PPPPPPPP    DDDDDDDD      SSSSSSSS  EEEEEEEEEE    CCCCCCCC
SS          YY      YY  SS          UU      UU  PP      PP  DD      DD  SS          EE          CC
SS          YY      YY  SS          UU      UU  PP      PP  DD      DD  SS          EE          CC
SS            YY  YY    SS          UU      UU  PP      PP  DD      DD  SS          EE          CC
SS            YY  YY    SS          UU      UU  PP      PP  DD      DD  SS          EE          CC
  SSSSSS        YY        SSSSSS    UU      UU  PPPPPPPP    DD      DD    SSSSSS    EEEEEEEE    CC
  SSSSSS        YY        SSSSSS    UU      UU  PPPPPPPP    DD      DD    SSSSSS    EEEEEEEE    CC
        SS      YY              SS  UU      UU  PP          DD      DD          SS  EE          CC
        SS      YY              SS  UU      UU  PP          DD      DD          SS  EE          CC
        SS      YY              SS  UU      UU  PP          DD      DD          SS  EE          CC              ....
        SS      YY              SS  UU      UU  PP          DD      DD          SS  EE          CC              ....
SSSSSSSS        YY      SSSSSSSS  UUUUUUUUUU  PP          DDDDDDDD    SSSSSSSS    EEEEEEEEEE    CCCCCCCC      ....
SSSSSSSS        YY      SSSSSSSS  UUUUUUUUUU  PP          DDDDDDDD    SSSSSSSS    EEEEEEEEEE    CCCCCCCC      ....

LL            IIIIII      SSSSSSSS
LL            IIIIII      SSSSSSSS
LL              II      SS
LL              II      SS
LL              II      SS
LL              II      SS
LL              II        SSSSSS
LL              II        SSSSSS
LL              II              SS
LL              II              SS
LL              II              SS
LL              II              SS
LLLLLLLLLL    IIIIII    SSSSSSSS
LLLLLLLLLL    IIIIII    SSSSSSSS
```

Table of contents

```
0000          .TITLE  SYSUPDSEC - Update Section File System Service
0000          .IDENT  'V04-000'
0000    ;
0000    ;****************************************************************************
0000    ;*                                                                          *
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0000    ;*                                                                          *
0000    ;****************************************************************************
0000
0000    ;++
0000    ; FACILITY:     UPDATE SECTION SYSTEM SERVICE
0000    ;
0000    ; ABSTRACT:
0000    ;
0000    ; ENVIRONMENT:
0000    ;
0000    ; AUTHOR: PETER H. LIPMAN       , CREATION DATE: 21-APR-78
0000    ;
0000    ; MODIFIED BY:
0000    ;
0000    ;       V03-002 WMC0001         Wayne Cardoza           02-Mar-1983
0000    ;               MMG$CRECOM2 has gone away, MMG$INADRINI returns status
0000    ;
0000    ;       V03-001 SOP0001         J. R. Sopka             27 August 1982
0000    ;               Add XIP_B_MAXACMODE field to IRP extension used by $UPDSEC
0000    ;               and use it for page owner access mode instead of IRP$B_RMOD
0000    ;               which should contan the mode of the requestor.
0000    ;
0000    ;--
```

```
                 0000              .SBTTL  DECLARATIONS
                 0000      ;
                 0000      ; INCLUDE FILES:
                 0000      ;
                 0000              $ACBDEF                         ;AST control block definitions
                 0000              $CADEF                          ;Conditional assembly definitions
                 0000              $DYNDEF                         ;Dynamic data structure type codes
                 0000              $GSDDEF                         ;Global section descriptor definitions
                 0000              $IRPDEF                         ;I/O request packet definitions
                 0000              $IPLDEF                         ;Processor priority levels
                 0000              $MMGDEF                         ; Offsets from FP into scratch area
                 0000              $PCBDEF                         ;Process control block definitions
                 0000              $PFNDEF                         ;Page frame number data base definitions
                 0000              $PHDDEF                         ;Process header definitions
                 0000              $PRDEF                          ;Processor register definitions
                 0000              $PRIDEF                         ;Priority increment class definitions
                 0000              $PSLDEF                         ;Processor Status Long Word definitions
                 0000              $PTEDEF                         ;Page table entry definitions
                 0000              $RSNDEF                         ;Resource definitions
                 0000              $SECDEF                         ;Section table entry definitions
                 0000              $SHBDEF                         ;Shared memory control block definitions
                 0000              $SSDEF                          ;System status code definitions
                 0000              $VADEF                          ;Virtual address field definitions
                 0000      ;
                 0000      ; MACROS:
                 0000      ;
                 0000
                 0000      ;
                 0000      ; EQUATED SYMBOLS:
                 0000      ;
                 0000      ; Offset from AP
                 0000      ;
        00000004 0000              INADR           = 4             ;Offset to input range
        00000008 0000              RETADR          = 8             ;Offset to return range
        0000000C 0000              ACMODE          = 12            ;Access Mode
        00000010 0000              FLAGS           = 16            ;Flags parameter
        00000014 0000              EFN             = 20            ;QI/O Event Flag
        00000018 0000              IOSB            = 24            ;QI/O I/O Status Block Address
        0000001C 0000              ASTADR          = 28            ;QI/O AST address
        00000020 0000              ASTPRM          = 32            ;QI/O AST parameter
                 0000      ;
                 0000      ; Offsets into I/O packet while being used as scratch storage for clustering
                 0000      ;
                 0000              $OFFSET 0,POSITIVE,<-
                 0000                      SVAPTE,-                ;Master page table entry address
                 0000                      PTEDAT,-                ;Process PTE data
                 0000                      <,3>,-
                 0000                      <IRP_RMOD,1>,-          ;Request mode
                 0000                      MFYCNT,-                ;Cluster count at last modified page
                 0000                      IRP_AST,-               ;Ast address
                 0000                      IRP_ASTPRM,-            ;Ast parameter
                 0000                      CLUSTER,-               ;Maximum size of cluster to scan for
                 0000                      COUNT,-                 ;Number of pages scanned
                 0000                      <EXCLWRT,1>,-           ;Exclusive write access flag
                 0000                      <,1>,-
                 0000                      <IRP_EFN,1>,-           ;Event flag
                 0000                      <IRP_PRI,1>,-           ;Priority
```

```
0000                          IRP_IOSB,-                  ;I/O status block address
0000                          INCT,-                      ;+ or - 1 according to direction
0000                          INC4,-                      ;+ or - 4 according to direction
0000                          BAK,-                       ;Backing store address of first PTE
0000                          <,4>,-
0000                          <IRP_IOST1,8>,-             ;I/O status return area
0000                          PROCPTE,-                   ;Process page table entry address
0000                          <,4>,-
0000                          IRP_SEGVBN,-                ;Starting virtual address of scan
0000                          <IRP_LENGTH,0>-             ;Total size of scratch area used
0000                          >
0000      SVAPTE:
0004      PTEDAT:
000B      IRP_RMOD:
000C      MFYCNT:
0010      IRP_AST:
0014      IRP_ASTPRM:
0018      CLUSTER:
001C      COUNT:
0020      EXCLWRT:
0022      IRP_EFN:
0023      IRP_PRI:
0024      IRP_IOSB:
0028      INCT:
002C      INC4:
0030      BAK:
0038      IRP_IOST1:
0040      PROCPTE:
0048      IRP_SEGVBN:
004C      IRP_LENGTH:
0000
0000              ASSUME  IRP_LENGTH      LE IRP$C_LENGTH
0000              ASSUME  IRP_RMOD        EQ IRP$B_RMOD
0000              ASSUME  IRP_AST         EQ IRP$L_AST
0000              ASSUME  IRP_ASTPRM      EQ IRP$L_ASTPRM
0000              ASSUME  IRP_EFN         EQ IRP$B_EFN
0000              ASSUME  IRP_PRI         EQ IRP$B_PRI
0000              ASSUME  IRP_IOSB        EQ IRP$L_IOSB
0000              ASSUME  IRP_IOST1       EQ IRP$L_IOST1
0000              ASSUME  IRP_SEGVBN      EQ IRP$L_SEGVBN
0000      ;
0000      ; Offsets off the end of the I/O request packet
0000      ;
0000              $OFFSET IRP$C_LENGTH,POSITIVE,<-
0000                          XIP_L_SCANCNT,-             ;Count - 1 of pages remaining to scan
0000                          XIP_L_DIREC,-               ;+ OR - 200 according to the direction
0000                          XIP_L_STARTVA,-             ;Starting virtual address to scan
0000                          <XIP_B_UPDFLG,1>,-          ;Section update flags
0000                          <XIP_B_MAXACMODE,1>,-       ;Maximzed access mode for page ownership
0000                          <,2>,-                      ;Spare
0000                          <XIP_C_LENGTH,0> -          ;Length of extended I/O packet
0000                          >
00C4      XIP_L_SCANCNT:
00C8      XIP_L_DIREC:
00CC      XIP_L_STARTVA:
00D0      XIP_B_UPDFLG:
00D1      XIP_B_MAXACMODE:
```

```
                   00D4      XIP_C_LENGTH:
                   0000  138 ;
                   0000  139 ; OWN STORAGE:
                   0000  140 ;
                   0000  141         .LIST   MEB
```

```
0000            .SBTTL  UPDSEC - Update Section File
0000    ;++
0000    ; FUNCTIONAL DESCRIPTION:
0000    ;
0000    ; CALLING SEQUENCE:
0000    ;
0000    ;       CALLG   ARGLIST,G^SYS$UPDSEC
0000    ;
0000    ;
0000    ; INPUT PARAMETERS:
0000    ;
0000    ;       INADR(AP) = Address of 2 long words the 1st of which specifies
0000    ;               the starting virtual address, the 2nd specifies the ending
0000    ;               virtual address (inclusive) of the pages to operate on.
0000    ;       RETADR(AP) = Address of a 2 longword array into which is returned
0000    ;               the starting and ending virtual addresses (inclusive)
0000    ;               of the pages operated on.
0000    ;       ACMODE(AP) = The access mode (maximized with calling mode)
0000    ;               against which the page ownership is checked.
0000    ;               Only the owner of a page may update its section.
0000    ;       FLAGS(AP)  = Update section control flags
0000    ;       EFN(AP)    = Event flag number to set on write complete
0000    ;       IOSB(AP)   = I/O status block address for reporting the
0000    ;                    write completion and its status
0000    ;                       First word contains the system status.
0000    ;                       If error status is returned in the first word,
0000    ;                    the first bit of the 2nd word (bit 16 of the first
0000    ;                    long word) will be set if a write error occurred.
0000    ;                    Other errors (e.g. page owner violation) are possible.
0000    ;                       The second long word contains the first virtual
0000    ;                    address not written.
0000    ;       ASTADR(AP) = AST address for reporting write completion
0000    ;       ASTPRM(AP) = AST parameter for identifying the AST
0000    ;
0000    ; IMPLICIT INPUTS:
0000    ;
0000    ;       NONE
0000    ;
0000    ; OUTPUT PARAMETERS:
0000    ;
0000    ;       R0 = System Status Code
0000    ;
0000    ; IMPLICIT OUTPUTS:
0000    ;
0000    ;       NONE
0000    ;
0000    ; COMPLETION CODES:
0000    ;
0000    ;       SS$_NORMAL                      ;Successful Completion
0000    ;       SS$_ACCVIO                      ;Access Violation
0000    ;       SS$_PAGOWNVIO                   ;Page Owner Violation
0000    ;       SS$_EXQUOTA                     ;Quota exceeded for pending AST's
0000    ;       SS$_IVSECFLG                    ;Invalid flags set
0000    ;
0000    ; SIDE EFFECTS:
0000    ;
0000    ;       NONE
```

```
                          0000       ;
                          0000       ;--
                          0000       ;
                          0000       ; *********************************************************************
                          0000       ;
                          0000       ; **************** THE FOLLOWING CODE MAY BE PAGED *****************
                          0000       ;
                      00000000                 .PSECT  Y$EXEPAGED
                          0000       ;
                          0000       ; *********************************************************************
                          0000       ;
                          0000
                          0000       INADRERR:
                      04  0000                 RET
                          0001
                    01FC  0001                 .ENTRY  EXE$UPDSEC,^M<R2,R3,R4,R5,R6,R7,R8>
                          0003
          5E   1C     C2  0003                 SUBL    S^#-MMG$C_LENGTH,SP      ;Reserve area indexed from FP
          58   54     D0  0006                 MOVL    R4,R8                    ;Save PCB address
             FFF4'    30  0009                 BSBW    MMG$INADRINI             ;Get input address range to R4,R5
                          000C                                                  ;Init return range to null
             F1 50    E9  000C                 BLBC    R0,INADRERR
                30    BB  000F                 PUSHR   #^M<R4,R5>               ;Save input address range
           54   58    D0  0011                 MOVL    R8,R4                    ;Restore PCB address
        53   14 AC    9A  0014                 MOVZBL  EFN(AP),R3               ;Get the event flag parameter
       00000000'EF    16  0018                 JSB     SCH$CLREF                ;Clear the specified event flag
        56   18 AC    D0  001E                 MOVL    IOSB(AP),R6              ;Get I/O status block address
                08    13  0022                 BEQL    20$                      ;Branch if none specified
                          0024                 IFNOWRT #8,(R6),70$              ;Make sure caller could write it
     66    08    00   0D  0024                         PROBEW  #0,#8,(R6)
                 7F   13  0028                         BEQL    70$
                 66   7C  002A                 CLRQ    (R6)                     ;and initialize it
       57    10 AC    D0  002C       20$:      MOVL    FLAGS(AP),R7             ;Get FLAGS parameter
          01    57    D1  0030                 CMPL    R7,#1                    ;Make sure no garbage bits are set
                6D    1A  0033                 BGTRU   60$                      ;Branch if invalid section flags
   51  000000D4 8F    D0  0035                 MOVL    #XIP_C_LENGTH,R1         ;Size of packet to allocate
       00000000'EF    16  003C                 JSB     EXE$ALLOCBUF             ;Allocate, wait if necessary
                          0042                                                  ;Packet type is corrected by WRTPGSBAK
             67 50    E9  0042                 BLBC    R0,80$                   ;Branch if failed to alloc
                          0045                                                  ;and resource wait disabled
                          0045       ;
                          0045       ; IPL = ASTDEL, I/O request packet allocated
                          0045       ;
           58_  52    D0  0045                 MOVL    R2,R8                    ;Packet address to stable registter
        52   3E A4    9E  0048                 MOVAB   PCB$W_DIOCNT(R4),R2      ;Check for Direct I/O quota
       00000000'EF    16  004C                 JSB     EXE$SNGLEQUOTA           ;and wait if none available
             5B 50    E9  0052                 BLBC    R0,120$                  ;Branch if exceeded quota
                          0055                                                  ;and resource wait is disabled
                50    DC  0055                 MOVPSL  R0                       ;Get mode of the requestor
 50    50    02   16  EF  0057                 EXTZV   #PSL$V_PRVMOD,#PSL$S_PRVMOD,R0,R0
             FC AD    90  005C                 MOVB    B^MMG$C_MAXACMODE(FP),-  ;Get maximized access mode
             00D1 C8      005F                         XIP_B_MAXACMODE(R8)      ; for page ownership checking
     10 A8   1C AC    7D  0062                 MOVQ    ASTADR(AP),IRP$L_AST(R8) ;Set AST address and parameter
             10 A8    D5  0067                 TSTL    IRP$L_AST(R8)            ;AST requested?
                0C    13  006A                 BEQL    40$                      ;Branch if not
             38 A4    B5  006C                 TSTW    PCB$W_ASTCNT(R4)         ;Yes, quota exceeded?
                3F    15  006F                 BLEQ    120$                     ;Branch if yes, don't wait
          38 A4    B7  0071     255             DECW     PCB$W_ASTCNT(R4)          ;Charge for the AST
     50   40 8F    88  0074     256             BISB     #ACB$M_QUOTA,R0           ;And note that it is charged
     0B A8    50   90  0078     257 40$:        MOVB     R0,IRP$B_RMOD(R8)         ;Set requesting mode and AST flag
  22 A8    14 AC   90  007C     258             MOVB     EFN(AP),IRP$B_EFN(R8)     ;Set event flag number
     24 A8    56   D0  0081     259             MOVL     R6,IRP$L_IOSB(R8)         ;Set I/O status block address
   00D0 C8    57   90  0085     260             MOVB     R7,XIP_B_UPDFLG(R8)       ;Set section update flags
     56     E9'AF  9E  008A     261             MOVAB    B^MMG$UPDSECPAG,R6        ;Address of per page subroutine
              0C   BA  008E     262             POPR     #^M<R2,R3>                ;Recover saved input address range
           FF6D'   30  0090     263             BSBW     MMG$CREDEL                ;Common address range loop
              50   DD  0093     264             PUSHL    R0                        ;Save status
           FF68'   30  0095     265             BSBW     MMG$RETRANGE
           02 50   E9  0098     266             BLBC     R0,45$
                                                                                   ;Use this bad status rather than CREDEL
              50   BA  009B     267             POPR     R0
              58   D5  009D     268 45$:        TSTL     R8                        ;I/O packet to be released?
              12   12  009F     269             BNEQ     130$                      ;Branch if yes
              04       00A1     270 50$:        RET                                ;Write was queued successfully
                       00A2     271
  50    016C 8F    3C  00A2     272 60$:        MOVZWL   #SS$_IVSECFLG,R0          ;Invalid section flags parameter
              03   11  00A7     273             BRB      80$
        50    0C   3C  00A9     274 70$:        MOVZWL   #SS$_ACCVIO,R0            ;Access violation
              50   DD  00AC     275 80$:        PUSHL    R0                        ;Save the status code
              16   11  00AE     276             BRB      140$
                       00B0     277 ;
                       00B0     278 ; Release the I/O request packet, it was never used
                       00B0     279 ;
        50    1C   3C  00B0     280 120$:       MOVZWL   #SS$_EXQUOTA,R0           ;Exceeded quota
              50   DD  00B3     281 130$:       PUSHL    R0                        ;Save status
  03 0B A8    06   E5  00B5     282             BBCC     #ACB$V_QUOTA,IRP$B_RMOD(R8),135$ ;If charged for AST
           38 A4   B6  00BA     283             INCW     PCB$W_ASTCNT(R4)          ;then give back the quota
        50    58   D0  00BD     284 135$:       MOVL     R8,R0                     ;Get I/O packet address to release
    00000000'EF    16  00C0     285             JSB      EXE$DEANONPAGED           ;Release the I/O request packet
                       00C6     286 ;
                       00C6     287 ; Set the event flag so that the caller may wait for it despite the return
                       00C6     288 ; information showing that nothing was queued.
                       00C6     289 ;
  53     14 AC     9A  00C6     290 140$:       MOVZBL   EFN(AP),R3                ;Get the event flag number
  51     60 A4     D0  00CA     291             MOVL     PCB$L_PID(R4),R1          ;and the process ID
     52     01     9A  00CE     292             MOVZBL   #PRI$_IOCOM,R2            ;and the correct priority increment
    00000000'EF    16  00D1     293             JSB      SCH$POSTEF                ;Post the event flag, write complete
              01   BA  00D7     294             POPR     #^M<R0>                   ;Restore saved status
  51     18 AC     D0  00D9     295             MOVL     IOSB(AP),R1               ;I/O status requested?
              09   13  00DD     296             BEQL     150$                      ;Branch if not
                       00DF     297             IFNOWRT  #8,(R1),150$              ;Branch if IOSB not writable
  61    08    00   0D  00DF                      PROBEW   #0,#8,(R1)
              03   13  00E3                      BEQL     150$
        61    50   D0  00E5     298             MOVL     R0,(R1)                   ;Return the error status
              04       00E8     299 150$:       RET                                ;and return
    00E9        .SBTTL  UPDSECPAG - Update Section for First Cluster of Pages
    00E9  ;
    00E9  ; ***********************************************************************
    00E9  ;
    00E9  ; **************** THE FOLLOWING CODE MAY BE PAGED *****************
    00E9  ;
000000E9        .PSECT  Y$EXEPAGED
    00E9  ;
    00E9  ; ***********************************************************************
    00E9  ;
    00E9  ;++
    00E9  ; FUNCTIONAL DESCRIPTION:
    00E9  ;
    00E9  ;
    00E9  ; CALLING SEQUENCE:
    00E9  ;
    00E9  ;       BSBW    MMG$UPDSECPAG
    00E9  ;
    00E9  ;
    00E9  ; INPUT PARAMETERS:
    00E9  ;
    00E9  ;       R0 = Access Mode for page ownership check
    00E9  ;       R2 = Virtual Address
    00E9  ;       R4 = Current PCB address
    00E9  ;       R5 = Process Header Address - P1 or System Space
    00E9  ;       R6 = Count - 1 of pages to be processed including this one
    00E9  ;       R7 = +^X200 if going forward in the address space
    00E9  ;          = -^X200 if going backwards in the address space
    00E9  ;       R8 = Address of an extended length I/O request packet
    00E9  ;               IRP$W_SIZE      = size of extended IRP (XIP_C_LENGTH)
    00E9  ;                                 type filled in by WRTPGSBAK
    00E9  ;               IRP$L_ASTADR    = AST address if desired
    00E9  ;               IRP$L_ASTPRM    = AST parameter
    00E9  ;               IRP$B_RMOD      = Requesting mode
    00E9  ;                                 ACB$V_QUOTA set if AST desired
    00E9  ;               IRP$B_EFN       = Event flag number
    00E9  ;               XIP_L_DIREC     = + OR - ^X200 according to direction of scan
    00E9  ;               XIP_B_UPDFLG    = Update section flags
    00E9  ;
    00E9  ;       IPL = ASTDEL
    00E9  ;
    00E9  ; IMPLICIT INPUTS:
    00E9  ;       NONE
    00E9  ;
    00E9  ; OUTPUT PARAMETERS:
    00E9  ;
    00E9  ;       R0 = Status Code
    00E9  ;       R2   Preserved
    00E9  ;
    00E9  ; IMPLICIT OUTPUTS:
    00E9  ;       NONE
    00E9  ;
    00E9  ; COMPLETION CODES:
    00E9  ;
    00E9  ;       SS$_NORMAL                      ;Successful Completion
    00E9  ;       SS$_PAGOWNVIO                   ;Page Owner Violation
    00E9  ;       SS$_LENVIO                      ;Length Violation
```

```
                              00E9  ;        SS$_ACCVIO                       ;Access Violation
                              00E9  ;
                              00E9  ; SIDE EFFECTS:
                              00E9  ;
                              00E9  ;        NONE
                              00E9  ;
                              00E9  ;--
                              00E9
                              00E9  MMG$UPDSECPAG:
 00C8 C8     57      D0       00E9           MOVL    R7,XIP_L_DIREC(R8)       ;Save direction of scan
  00000000'EF        16       00EE           JSB     MMG$UPDSECQWT            ;Find and queue the next cluster
             51      D5       00F4           TSTL    R1                       ;Anything queued for writing?
             0D      12       00F6           BNEQ    20$                      ;Branch if yes
          F4 AD      D4       00F8           CLRL    B^MMG$L_SAVRETADR(FP)    ;Return a null range
          15 50      E9       00FB           BLBC    R0,60$                   ;Branch if error status
 50    0659 8F       3C       00FE           MOVZWL  #SS$_NOTMODIFIED,R0      ;Otherwise return alternate success code
             0E      11       0103           BRB     60$
             58      D4       0105  20$:     CLRL    R8                       ;Note I/O packet in use
    EC AD    52      D0       0107           MOVL    R2,B^MMG$L_SVSTARTVA(FP) ;Return first address queued
             51      D7       010B           DECL    R1                       ;Page count - 1
       51    57      C4       010D           MULL    R7,R1                    ;Byte count
       52    51      C0       0110           ADDL    R1,R2                    ;Address of last page queued
             56      D4       0113  60$:     CLRL    R6                       ;Force end of range
                     05       0115           RSB                              ;and return
```

```
0116          .SBTTL  UPDSECAST - Update Section AST
0116    ;++
0116    ; FUNCTIONAL DESCRIPTION:
0116    ;
0116    ;       This is a special kernel AST routine invoked by IOPOST at the
0116    ; completion of a PAGIO write request with an extended I/O packet.
0116    ; It's job is to find the next cluster of modified pages to write
0116    ; and either queue the request or post the I/O completion.
0116    ;
0116    ; CALLING SEQUENCE:
0116    ;
0116    ;       BSBW    MMG$UPDSECAST
0116    ;
0116    ;
0116    ; INPUT PARAMETERS:
0116    ;
0116    ;       R4 = Current PCB address
0116    ;       R5 = Address of an extended length I/O request packet
0116    ;               IRP$W_SIZE      = size of extended IRP (XIP_C_LENGTH)
0116    ;               IRP$B_TYPE      = DYN$C_IRP
0116    ;               IRP$L_ASTADR    = AST address if desired
0116    ;               IRP$L_ASTPRM    = AST parameter
0116    ;               IRP$B_RMOD      = Requesting mode
0116    ;                                 ACB$V_QUOTA set if AST desired
0116    ;               IRP$B_EFN       = Event flag number
0116    ;               XIP_L_SCANCNT   = Count - 1 of pages left to scan
0116    ;                                 before this transfer completed
0116    ;               XIP_L_DIREC     = + OR - ^X200 according to direction of scan
0116    ;               XIP_L_STARTVA   = First VA used for this transfer
0116    ;               XIP_B_UPDFLG    = Update section flags
0116    ;               XIP_B_MAXACMODE = Maximized access mode for page ownership
0116    ;               IPR$L_IOST1     = Status of previous write (0:15)
0116    ;                               = Number of bytes successfully written (16:31)
0116    ;
0116    ;       IPL = ASTDEL
0116    ;
0116    ; IMPLICIT INPUTS:
0116    ;       NONE
0116    ;
0116    ; OUTPUT PARAMETERS:
0116    ;
0116    ;
0116    ; IMPLICIT OUTPUTS:
0116    ;       NONE
0116    ;
0116    ; COMPLETION CODES:
0116    ;
0116    ;
0116    ; SIDE EFFECTS:
0116    ;
0116    ;       NONE
0116    ;
0116    ;--
```

```
                              0116  ;
                              0116  ; ************************************************************
                              0116  ;
                              0116  ; *************** THE FOLLOWING CODE MAY BE PAGED ****************
                              0116  ;
                          00000116          .PSECT  Y$EXEPAGED
                              0116  ;
                              0116  ; ************************************************************
                              0116  ;
                              0116  ;
                              0116  MMG$UPDSECAST::
           01C0 8F       BB   0116          PUSHR   #^M<R6,R7,R8>           ;Save these registers
             58   55     D0   011A          MOVL    R5,R8                   ;I/O request packet address
   55   00000000'GF      D0   011D          MOVL    G^CTL$GL_PHD,R5         ;Get P1 address of process header
                              0124
                              0124          ASSUME  XIP_L_DIREC EQ XIP_L_SCANCNT+4
      56   00C4 C8       7D   0124          MOVQ    XIP_L_SCANCNT(R8),R6    ;R6=count-1, R7=+ or - ^X200
      52   00CC C8       D0   0129          MOVL    XIP_L_STARTVA(R8),R2    ;R2 = first VA of this transfer
         50   38 A8      D0   012E          MOVL    IRP$L_IOST1(R8),R0      ;Get status and byte count
   51   50   07   19     EF   0132          EXTZV   #<16+VA$V_VPN>,#<16-VA$V_VPN>,R0,R1 ;Page count transferred
      53   51   57       C5   0137          MULL3   R7,R1,R3                ;Directional byte count
           52   53       C0   013B          ADDL    R3,R2                   ;New starting VA = first VA not written
        3C A8   52       D0   013E          MOVL    R2,IRP$L_IOST2(R8)      ;Save it as second IOSB long word
             17   50     E9   0142          BLBC    R0,100$                 ;Branch if write error
           56   51       C2   0145          SUBL    R1,R6                   ;Page count remaining to scan
                  12     19   0148          BLSS    100$                    ;Branch if did last piece
         00000000'EF     16   014A          JSB     MMG$UPDSECQWT           ;Scan for another cluster to write
             09   50     E9   0150          BLBC    R0,100$                 ;Dont continue scanning if error, branch
                  51     D5   0153          TSTL    R1                      ;Anything found and queued?
                  05     13   0155          BEQL    100$                    ;Branch if not
           01C0 8F       BA   0157          POPR    #^M<R6,R7,R8>           ;restore saved registers
                         05   015B          RSB                             ;and return from AST
                              015C  ;
                              015C  ; Last cluster of pages was written
                              015C  ; R0 = status
                              015C  ;
           55   58       D0   015C  100$:   MOVL    R8,R5                   ;I/O packet address back to R5
           01C0 8F       BA   015F          POPR    #^M<R6,R7,R8>           ;Restore registers
           50   50       3C   0163          MOVZWL  R0,R0                   ;Zero high 16 bits of status
        04 38 A5         E8   0166          BLBS    IRP$L_IOST1(R5),120$    ;Branch if not page write error
       00 50   10        E2   016A          BBSS    #16,R0,120$             ;Set page write error indication
       38 A5   50        D0   016E  120$:   MOVL    R0,IRP$L_IOST1(R5)      ;Set first long word of return status
       53   22 A5        9A   0172          MOVZBL  IRP$B_EFN(R5),R3        ;Get the event flag to post
       51   0C A5        D0   0176          MOVL    IRP$L_PID(R5),R1        ;Process ID
           52   01       9A   017A          MOVZBL  #PRI$_IOCOM,R2          ;Priority increment for I/O completion
         00000000'EF     16   017D          JSB     SCH$POSTEF              ;Post the event flag
         00000000'EF     17   0183          JMP     IOC$DIRPOST1            ;Go return status to IOSB if specified
                              0189                                          ;and issue AST if requested
```

```
0189          .SBTTL  UPDSECQWT - Update Section File for Single Page
0189
0189    ;++
0189    ; FUNCTIONAL DESCRIPTION:
0189    ;
0189    ;
0189    ; CALLING SEQUENCE:
0189    ;
0189    ;       BSBW    MMG$UPDSECQWT
0189    ;
0189    ;
0189    ; INPUT PARAMETERS:
0189    ;
0189    ;       R2 = Virtual Address
0189    ;       R4 = Current PCB address
0189    ;       R5 = Process Header Address - P1 or System Space
0189    ;       R6 = Count - 1 of pages to be processed including this one
0189    ;       R7 = +^X200 if going forward in the address space
0189    ;          = -^X200 if going backwards in the address space
0189    ;       R8 = Address of an extended length I/O request packet
0189    ;               IRP$W_SIZE       = size of extended IRP (XIP_C_LENGTH)
0189    ;                                  type filled in by WRTPGSBAK
0189    ;               IRP$L_ASTADR     = AST address if desired
0189    ;               IRP$L_ASTPRM     = AST parameter
0189    ;               IRP$B_RMOD       = Requesting mode
0189    ;                                  ACB$V_QUOTA set if AST desired
0189    ;               IRP$B_EFN        = Event flag number
0189    ;               XIP_L_DIREC      = + OR - ^X200 according to direction of scan
0189    ;               XIP_B_UPDFLG     = Update section flags
0189    ;               XIP_B_MAXACMODE  = Maximized access mode for page ownership
0189    ;
0189    ;       IPL = ASTDEL
0189    ;
0189    ; IMPLICIT INPUTS:
0189    ;       NONE
0189    ;
0189    ; OUTPUT PARAMETERS:
0189    ;
0189    ;    If write has been queued, then
0189    ;
0189    ;       R0 = #SS$_NORMAL
0189    ;       R1 = number of pages queued for writing
0189    ;       R2 = virtual address of first page (scan order) queued
0189    ;       R6 = count - 1 of pages remaining to scan starting with VA in R2;
0189    ;
0189    ;       Extended portion of I/O request packet updated if write queued
0189    ;               XIP_L_STARTVA    = starting virtual address of request just queued
0189    ;               XIP_L_SCANCNT    = count - 1 of pages remaining to scan
0189    ;                                  starting with the first page just queued
0189    ;
0189    ;    If write has not been queued, then
0189    ;
0189    ;       R0 = system status code
0189    ;       R1 = 0
0189    ;       R2 = last virtual address scanned
0189    ;            in the case of an error, this is the address that caused it
0189    ;            if ran off the end of range, this is the last VA in the range
```

```
SYS
Sym

PTE
PTE
PTE
PTE
PTE
PTE
PTE
PTE
PTE
PTE
PTE
PTE
PTE
PTE
RET
SAV
SCH
SCH
SEC
SEC
SEC
SEC
SHB
SHB
SHM
SS$
SS$
SS$
SS$
SS$
SS$
SS$
SVA
VA$
VA$
XIP
XIP
XIP
XIP
XIP
XIP



PSE
---
.
$AB
Y$E
$MM
```

```
    0189  ;        R6 = count - 1 of pages remaining to scan starting with VA in R2
    0189  ;           = 0 if at end of range and no more to do
    0189  ;
    0189  ; IMPLICIT OUTPUTS:
    0189  ;
    0189  ;        NONE
    0189  ;
    0189  ; COMPLETION CODES:
    0189  ;
    0189  ;        SS$_NORMAL                           ;Successful Completion
    0189  ;        SS$_PAGOWNVIO                        ;Page Owner Violation
    0189  ;        SS$_LENVIO                           ;Length Violation
    0189  ;        SS$_ACCVIO                           ;Access Violation
    0189  ;
    0189  ; SIDE EFFECTS:
    0189  ;
    0189  ;        NONE
    0189  ;
    0189  ;--
    0189  ;
    0189  ; *************************************************************************
    0189  ;
    0189  ; **************** THE FOLLOWING CODE MUST BE RESIDENT *****************
    0189  ;
00000000         .PSECT  $MMGCOD
    0000  ;
    0000  ; *************************************************************************
    0000  ;
```

```
SYS
VAX

Pha
---
Ini
Com
Pas
Sym
Pas
Sym
Pse
Cro
Ass

The
947
The
105
36

Mac
---
_$2
_$2
TOT

159

The

MAC
```

```
                           0000  MMG$UPDSECQWT:
               51    D4    0000                  CLRL      R1                         ;Initialize indicator to no pages queued
            FFFB'    30    0002                  BSBW      MMG$PTEINDX                ;Get index to page table entry
            64 50    E9    0005                  BLBC      R0,100$                    ;Branch if length violation
                           0008                  DSBINT    #IPL$_SYNCH                ;Push current IPL
         7E    12    DB    0008                            MFPR     S^#PR$_IPL,-(SP)
         12    08    DA    000B                            MTPR     #IPL$_SYNCH,S^#PR$_IPL
                           000E                                                       ;and raise to SYNCH
      53    6C B443  DE    000E                  MOVAL     @PCB$L_PHD(R4)[R3],R3      ;Form system virtual address of PTE
51    57      F9 8F  78    0013                  ASHL      #-7,R7,R1                  ;+ OR - 4 for adding to  SVAPTE
               0E    BB    0018       10$:       PUSHR     #^M<R1,R2,R3>
               52    D4    001A                  CLRL      R2                         ;PTEPFNMFY should return section/GPTX
      50    00D1 C8  9A    001C                  MOVZBL    XIP_B_MAXACMODE(R8),R0     ;Access mode to check against page owner
      51    00D0 C8  9A    0021                  MOVZBL    XIP_B_UPDFLG(R8),R1        ;Exclusive writer indication
             0254    30    0026                  BSBW      MMG$PTEPFNMFY              ;Get PFN and modify bit for this PTE
            06 51    E9    0029                  BLBC      R1,20$                     ;Branch if page not a candidate for write
               51    95    002C                  TSTB      R1                         ;Could be written, is it modified?
               21    19    002E                  BLSS      70$                        ;Branch if yes, go write a cluster
               05    11    0030                  BRB       30$                        ;No, try the next page if any
         50    51    D0    0032       20$:       MOVL      R1,R0                      ;Error, or just not a candidate?
               14    12    0035                  BNEQ      60$                        ;Branch if error
               0E    BA    0037       30$:       POPR      #^M<R1,R2,R3>              ;R3=SVAPTE, R2=VA, R1=+ or - 4
               56    D5    0039                  TSTL      R6                         ;Check for end of loop
               09    13    003B                  BEQL      40$                        ;Avoid modifying VA and Count
         52    57    C0    003D                  ADDL      R7,R2                      ;Next virtual address
         53    51    C0    0040                  ADDL      R1,R3                      ;and next PTE address
            D2 56    F4    0043                  SOBGEQ    R6,10$                     ;Try the next page
         50    01    3C    0046       40$:       MOVZWL    #SS$_NORMAL,R0             ;End of range, no more to do
               02    11    0049                  BRB       65$
               0E    BA    004B       60$:       POPR      #^M<R1,R2,R3>
               51    D4    004D       65$:       CLRL      R1                         ;No pages queued for writing
               18    11    004F                  BRB       80$
                           0051       ;
                           0051       ; Found a page to start the cluster, queue a cluster of pages
                           0051       ;
               02    BA    0051       70$:       POPR      #^M<R1>                    ;Clean off + or - 4
      00CC C8  6E    D0    0053                  MOVL      (SP),XIP_L_STARTVA(R8)     ;Save starting VA for UPDSECAST
        48 A8  6E    D0    0058                  MOVL      (SP),IRP$L_SEGVBN(R8)      ;and for WRTPGSBAK
      00C4 C8  56    D0    005C                  MOVL      R6,XIP_L_SCANCNT(R8)       ;and remaining count for this write
         51    58    D0    0061                  MOVL      R8,R1                      ;I/O request packet (extended)
             0006    30    0064                  BSBW      MMG$WRTPGSBAK              ;Queue a cluster for write back
               0C    BA    0067                  POPR      #^M<R2,R3>                 ;Restore saved VA, clean off SVAPTE
                           0069       80$:       ENBINT                               ;Back to called IPL
         12    8E    DA    0069                            MTPR     (SP)+,S^#PR$_IPL
                     05    006C       100$:      RSB
```

```
006D            .SBTTL  WRTPGSBAK - Write Pages Back to Disk
006D    ;++
006D    ; FUNCTIONAL DESCRIPTION:
006D    ;
006D    ;
006D    ; CALLING SEQUENCE:
006D    ;
006D    ;       BSBW    MMG$WRTPGSBAK
006D    ;
006D    ;
006D    ; INPUT PARAMETERS:
006D    ;
006D    ;       R0 = Page Frame Number of starting page
006D    ;       R1 = Address of an I/O request packet
006D    ;               IRP$W_SIZE      = XIP_C_LENGTH if called by UPDSEC
006D    ;                               = IRP$C_LENGTH if called by DELPAG
006D    ;               IRP$B_TYPE      = type filled in by WRTPGSBAK
006D    ;               IRP$L_ASTADR    = AST address if desired
006D    ;               IRP$L_ASTPRM    = AST parameter
006D    ;               IRP$B_RMOD      = Requesting mode
006D    ;                                 ACB$V_QUOTA set if AST desired
006D    ;               IRP$B_EFN       = Event flag number
006D    ;               IRP$L_SEGVBN    = Starting virtual address of scan
006D    ;               XIP_B_UPDFLG    = Update section flags (if extended packet)
006D    ;               XIP_B_MAXACMODE = Maximized access mode for page ownership
006D    ;       R2 = Section backing store address (PFN$AL_BAK[R0])
006D    ;            if process section page or shared memory global page
006D    ;          = Global page table index if global page
006D    ;       R3 = System virtual address of process page table entry for first page
006D    ;       R4 = PCB address
006D    ;       R5 = Process header address - P1 or System Space
006D    ;       R6 = Count - 1 of pages remaining to be processed including this one
006D    ;       R7 = +^X200 if going forward in address space
006D    ;          = -^X200 if going backwards in address space
006D    ;       IPL = SYNCH
006D    ;
006D    ; IMPLICIT INPUTS:
006D    ;
006D    ;       NONE
006D    ;
006D    ; OUTPUT PARAMETERS:
006D    ;
006D    ;       R0 = #SS$_NORMAL
006D    ;       R1 = Number of pages queued for writing
006D    ;       R2,R3 Scratched
006D    ;
006D    ; IMPLICIT OUTPUTS:
006D    ;       NONE
006D    ;
006D    ; COMPLETION CODES:
006D    ;
006D    ;
006D    ; SIDE EFFECTS:
006D    ;
006D    ;
006D    ;--
```

```
                                   006D  ;
                                   006D  ; ****************************************************************
                                   006D  ;
                                   006D  ; **************** THE FOLLOWING CODE MUST BE RESIDENT *****************
                                   006D  ;
                               0000006D          .PSECT  $MMGCOD
                                   006D  ;
                                   006D  ; ****************************************************************
                                   006D  ;
                                   006D  MMG$WRTPGSBAK::
                      30    BB     006D          PUSHR   #^M<R4,R5>                ;Preserve R4 and R5 across call
                                   006F  ;
                                   006F  ; Initialize I/O packet for cluster scan
                                   006F  ;
        2C A1   57    F9 8F  78    006F          ASHL    #-7,R7,INC4(R1)           ;+ or - 4 according to direction
        28 A1   57    F7 8F  78    0075          ASHL    #-9,R7,INC1(R1)           ;+ or - 1 according to direction
                   57    51  D0    007B          MOVL    R1,R7                     ;Packet address in stable register
              0A A7      0A  90    007E          MOVB    #DYN$C_IRP,IRP$B_TYPE(R7) ;Set packet type, size already set
         00000000'EF     50  D1    0082          CMPL    R0,MMG$GL_MAXPFN          ;Is page in shared memory?
                         32  1A    0089          BGTRU   50$                       ;Br if page is in shared memory gbl sec.
        30 A7   0000'DF40    D0    008B          MOVL    @W^PFN$AL_BAK[R0],BAK(R7) ;Actual section backing store
                                   0092                                            ;address even if global page
           67   0000'DF40    D0    0092          MOVL    @W^PFN$AL_PTE[R0],SVAPTE(R7) ;Master PTE address even if global
              40 A7      53  D0    0098  30$:    MOVL    R3,PROCPTE(R7)            ;Keep process pte address
              04 A7      52  D0    009C          MOVL    R2,PTEDAT(R7)             ;Save section adr/GPTX
           23 A7      2F A4  90    00A0          MOVB    PCB$B_PRIB(R4),IRP$B_PRI(R7) ;Set transfer priority
                                   00A5  ;
                                   00A5  ; Calculate largest cluster size as the minimum of the default cluster
                                   00A5  ; size and the number of pages left to operate on.
                                   00A5  ;
           51      0000'CF   3C    00A5          MOVZWL  W^MPW$GW_MPWPFC,R1        ;Default cluster size
                 51      56  D1    00AA          CMPL    R6,R1                     ;If count-1 is smaller
                         04  18    00AD          BGEQ    40$
              51     01  A6  DE    00AF          MOVAL   1(R6),R1                  ;then use count as max cluster size
              18 A7      51  D0    00B3  40$:    MOVL    R1,CLUSTER(R7)            ;Set maximum cluster size
              1C A7      01  D0    00B7          MOVL    #1,COUNT(R7)              ;Count the first page in the cluster
                         3C  11    00BB          BRB     80$                       ;and loop zero or more times
                                   00BD  ;
                                   00BD  ; Shared Memory global section pages have no PFN data base.
                                   00BD  ;
              30 A7      52  D0    00BD  50$:    MOVL    R2,BAK(R7)                ;Use section table index
                 67      53  D0    00C1          MOVL    R3,SVAPTE(R7)             ;Process PTE is the Master PTE
                         D2  11    00C4          BRB     30$                       ;Join common code
                                   00C6  ;
                                   00C6  ; The loop that follows gathers pages to cluster write from the same section
                                   00C6  ; The pages must (of course) be resident, but not all of them must actually
                                   00C6  ; be modified.  For process section pages, cluster from the first page
                                   00C6  ; (guaranteed modified) through the last modified page up to the cluster size.
                                   00C6  ; For global pages, cluster write all the pages in the global writable
                                   00C6  ; section.  The state of the modified bit is indeterminate since it is
                                   00C6  ; maintained in the individual PTE's of the processes which map the section
                                   00C6  ;
              53     2C  A7  C0    00C6  60$:    ADDL    INC4(R7),R3               ;Next PTE address
              04 52      16  E0    00CA          BBS     #PTE$V_TYPO,R2,70$        ;If global page (not in sh mem)
              52     28  A7  C0    00CE          ADDL    INC1(R7),R2               ;then next GPTX as well
     50    0B A7    02   00  EF    00D2  70$:    EXTZV   #0,#2,IRP$B_RMOD(R7),R0   ;Requesting mode
                         51  D4    00D8          CLRL    R1                        ;Assume no update section flags
        00D4 8F    08 A7    B1  00DA              CMPW    IRP$W_SIZE(R7),#XIP_C_LENGTH ;If extended I/O packet
                      0A    19  00E0              BLSS    75$                          ;Then
          51    00D0 C7     90  00E2              MOVB    XIP_B_UPDFLG(R7),R1          ;  Use the save update section flags
          50    00D1 C7     9A  00E7              MOVZBL  XIP_B_MAXACMODE(R7),R0       ;  Use maximized mode not requesting mode
                    018E    30  00EC      75$:    BSBW    MMG$PTEPFNMFY                ;Get PFN and modify bit if resident
                   10 51    E9  00EF              BLBC    R1,120$                      ;Branch if not resident
                   1C A7    D6  00F2              INCL    COUNT(R7)                    ;Found another resident page
                      51    95  00F5              TSTB    R1                           ;See if it was modified
                      05    18  00F7              BGEQ    100$                         ;Branch if it was not
        0C A7      1C A7    D0  00F9      80$:    MOVL    COUNT(R7),MFYCNT(R7)         ;then update last modified page seen
              C4 18 A7      F5  00FE      100$:   SOBGTR  CLUSTER(R7),60$              ;Try the next page too
                                0102      ;
                                0102      ; Now lock all the pages in the cluster just found
                                0102      ;
                53    67    D0  0102      120$:   MOVL    SVAPTE(R7),R3                ;Get starting Master PTE
        51    0C A7   01    C3  0105              SUBL3   #1,MFYCNT(R7),R1             ;Count - 1 of pages in cluster
          51    2C A7       C4  010A              MULL    INC4(R7),R1                  ;* -4 if going backwards in address space
                      12    18  010E              BGEQ    130$                         ;Branch if only 1 page or going forwards
                                0110      ;
                                0110      ; Going backwards in the address space, form the correct starting
                                0110      ; PTE addresses and virtual address.
                                0110      ;
                53    51    C0  0110              ADDL    R1,R3                        ;Form starting master PTE address
                67    53    D0  0113              MOVL    R3,SVAPTE(R7)                ;and save it
             40 A7    51    C0  0116              ADDL    R1,PROCPTE(R7)               ;Form starting process PTE address
          51    51    07    78  011A              ASHL    #7,R1,R1                     ;(count - 1) * -512
             48 A7    51    C0  011E              ADDL    R1,IRP$L_SEGVBN(R7)          ;Form starting virtual address
       18 A7    0C A7       D0  0122      130$:   MOVL    MFYCNT(R7),CLUSTER(R7)       ;Loop count is to last modified page
                                0127      ;
                                0127      ; Given the Master PTE address get each page ready for the write request
                                0127      ;
  50    83    7B800000 8F   CB  0127      150$:   BICL3   #^C<PTE$M_VALID !-           ;Get relevant bits from PTE
                                012F              PTE$M_TYP1 ! PTE$M_TYP0 !-
                                012F              PTE$M_PGFLVB>,(R3)+,R0
                      35    19  012F              BLSS    260$                         ;Branch if page is valid
                      1E    13  0131              BEQL    200$                         ;Demand zero is inconsistent
        51    50    EA 8F   78  0133              ASHL    #-PTE$V_TYP0,R0,R1           ;as would be anything other
                      17    12  0138              BNEQ    200$                         ;than transition
                 03   00    EE  013A              EXTV    #PFN$V_LOC,#PFN$S_LOC,-      ;Get the page location (-4 to 3)
       52    0000'DF40          013D              @W^PFN$AB_STATE[R0],R2
                                0142              CASE    R2,<-
                                0142                      270$,-                       ;-1 = active
                                0142                      220$,-                       ;0  = on free page list
                                0142                      220$,-                       ;1  = on modified page list
                                0142                      220$,-                       ;2  = on bad page list
                                0142                      240$ -                       ;3  = release pending
                                0142                      >,TYPE=B,LIMIT=#-1
        04'   FF 8F    52   8F  0142              CASEB   R2,#-1,S^#<<30001$-30000$>/2>-1
                                0147      30000$:
                         0044'  0147              .SIGNED_WORD    270$-30000$
                         000E'  0149              .SIGNED_WORD    220$-30000$
                         000E'  014B              .SIGNED_WORD    220$-30000$
                         000E'  014D              .SIGNED_WORD    220$-30000$
                         0015'  014F              .SIGNED_WORD    240$-30000$
                                0151      30001$:
                                0151      200$:   BUG_CHECK WRTPGSBAK,FATAL            ;Write pages back - inconsistent data base
                          FEFF  0151                      .WORD   ^XFEFF
                    0004' 0153                   .IIF IDN <FATAL>,<FATAL> , .WORD        BUG$_WRTPGSBAK!4
                          0155    777 ;
                          0155    778 ; Page is on the free, modified, or bad page list, must remove it
                          0155    779 ;
                   53  DD 0155    780 220$:   PUSHL   R3                            ;Save next PTE address
                FEA6'  30 0157    781         BSBW    MMG$REMPFN                    ;Remove page from free or modified page list
                   08  BA 015A    782         POPR    #^M<R3>                       ;Restore next PTE address
           00      05  F0 015C    783 240$:   INSV    #PFN$C_WRTINPROG,#PFN$V_LOC,- ;Set state to
     0000'DF40     03     015F    784                 #PFN$S_LOC,@W^PFN$AB_STATE[R0] ;Write in progress
                   25  11 0164    785         BRB     270$
                          0166    786
                          0166    787 ;
                          0166    788 ; Master page table entry is valid, shut off PTE copy of Modify bit, and get PFN
                          0166    789 ;
        51    40 A7    D0 0166    790 260$:   MOVL    PROCPTE(R7),R1                ;Process page table entry address
                   61  D5 016A    791         TSTL    (R1)                          ;See if it contains a valid PTE
                   0B  18 016C    792         BGEQ    265$                          ;Branch if it does not
        07 61      1A  E5 016E    793         BBCC    #PTE$V_MODIFY,(R1),265$ ;Shut off process PTE modify bit
                          0172    794                                               ;Branch if it was already off
                          0172    795         INVALID IRP$L_SEGVBN(R7),R1           ;Invalidate translation buffer for
        51    48 A7    D0 0172                        MOVL     IRP$L_SEGVBN(R7),R1
             3A    51  DA 0176                        MTPR     R1,S^#PR$_TBIS
                          0179    796                                               ;process virtual address
                          0179    797
                          0179    798         ASSUME  PTE$V_MODIFY GE 24            ;PTE modify bit is in high byte
           FF A3   04  8A 0179    799 265$:   BICB    #PTE$M_MODIFY@-24,-1(R3) ;Shut off modify in master PTE
     50    50  15  00  EF 017D    800         EXTZV   #PTE$V_PFN,#PTE$S_PFN,R0,R0 ;Isolate PFN
      00000000'EF  50  D1 0182    801         CMPL    R0,MMG$GL_MAXPFN              ;Is there PFN data base? (SH MEM page)
                   0C  1A 0189    802         BGTRU   280$                          ;Br if there is none, page is in SH MEM
    0000'DF40   80 8F  8A 018B    803 270$:   BICB    #PFN$M_MODIFY,@W^PFN$AB_STATE[R0] ;Page not modified
          0000'DF40    B6 0192    804         INCW    @W^PFN$AW_REFCNT[R0]          ;Count an I/O reference
          40 A7    04  C0 0197    805 280$:   ADDL    #4,PROCPTE(R7)                ;Next process PTE address
  48 A7   00000200 8F  C0 019B    806         ADDL    #512,IRP$L_SEGVBN(R7)         ;Next process virtual address
          80 18 A7     F5 01A3    807         SOBGTR  CLUSTER(R7),150$              ;Loop through each page in the cluster
                          01A7    808 ;
                          01A7    809 ; Now set up to queue the packet for writing
                          01A7    810 ;
        52    30 A7    D0 01A7    811         MOVL    BAK(R7),R2                    ;Get original backing store address
                          01AB    812                                               ;section address is same for all pages
              53   67  D0 01AB    813         MOVL    SVAPTE(R7),R3                 ;Starting master PTE address
     50   63   15  00  EF 01AE    814         EXTZV   #PTE$V_PFN,#PTE$S_PFN,(R3),R0 ;Get PFN for first page to write
      00000000'EF  50  D1 01B3    815         CMPL    R0,MMG$GL_MAXPFN              ;Is this a shared memory gbl sec page?
                   31  1A 01BA    816         BGTRU   320$                          ;Br if page is in shared memory gbl sec
       05 04 A7    16  E0 01BC    817         BBS     #PTE$V_TYPO,PTEDAT(R7),300$ ;Branch if process section page
       55   0000'CF    D0 01C1    818         MOVL    W^MMG$GL_SYSPHD,R5            ;System header for global page
                FE37'  30 01C6    819 300$:   BSBW    MMG$INIBLDPKT                 ;Convert to file vbn and window
        51    0C A7    D0 01C9    820 310$:   MOVL    MFYCNT(R7),R1                 ;Count of pages to queue
                          01CD    821
               00000002   01CD    822         .IF     GT,CA$_MEASURE
             0000'CF   D6 01CD    823         INCL    W^PMS$GL_PWRITIO              ;Count number of write I/O requests
        0000'CF    51  C0 01D1    824         ADDL    R1,W^PMS$GL_PWRITES           ;Count number of pages written
                          01D6    825         .ENDC
                          01D6    826
              55   57  D0 01D6    827         MOVL    R7,R5                         ;I/O packet address
     57    28 A5   09  78 01D9    828         ASHL    #9,INC1(R5),R7                ;Restore R7
                   51  DD 01DE    829         PUSHL   R1                            ;Save page count to return to caller
        51    51   09  9C 01E0    830         ROTL    #9,R1,R1                      ;Form byte count to queue
```

```
          FE19'  30  01E4          BSBW    EXE$BUILDPKTW            ;Build and queue the packet for writing
     50     01   3C  01E7          MOVZWL  #SS$_NORMAL,R0           ;Indicate packet successfully queued
            32   BA  01EA          POPR    #^M<R1,R4,R5>            ;Return byte count in R1, restore R4,R5
            05       01EC          RSB                              ;and return
                     01ED
                     01ED      ;
                     01ED      ; COMPUTE THE VBN FOR THE FIRST PAGE IN THE CLUSTER, THE SECTION TABLE ADDRESS,
                     01ED      ; AND THE WINDOW ADDRESS.
                     01ED      ;
  55    0000'CF  D0  01ED      320$:   MOVL    W^MMG$GL_SYSPHD,R5       ;System process header (for gbl pages)
         52   52 32  01F2              CVTWL   R2,R2                    ;Section table index
51    55   20 A5 C1  01F5              ADDL3   PHD$L_PSTBASOFF(R5),R5,R1 ;Base of section table
       51   6142 DE  01FA              MOVAL   (R1)[R2],R1              ;Section table entry address
        0050  8F DB  01FE              PUSHR   #^M<R4,R6>               ;Save registers
      56      61 D0  0202              MOVL    SEC$L_GSD(R1),R6         ;Address of Global Section Descriptor
                     0205      ;
                     0205      ; Find the relative position of this page within the section.
                     0205      ;
          FDF8'  30  0205              BSBW    MMG$FINDSHD              ;Get sh mem ctl blk & common data page
     50   10 A4  C2  0208              SUBL2   SHB$L_BASGSPFN(R4),R0    ;Get relative PFN within the sh mem
     56   54 A6  9E  020C              MOVAB   GSD$L_BASPFN1(R6),R6     ;Get adr of first PFN base in GSD
       52    04  9A  0210              MOVZBL  #GSD$C_PFNBASMAX,R2      ;Get number of PFN bases allowed
             55  D4  0213              CLRL    R5                       ;Zero relative page offset within sec
       66    50  D1  0215      330$:   CMPL    R0,(R6)                  ;Is PFN less than this base?
             09  19  0218              BLSS    340$                     ;Br if less than, not within this piece
  54   66    86  C1  021A              ADDL3   (R6)+,(R6),R4            ;Get PFN past end of this piece
       54    50  D1  021E              CMPL    R0,R4                    ;Is PFN less than end of piece?
             0A  19  0221              BLSS    350$                     ;Br if less than, is within this piece
       55    86  C0  0223      340$:   ADDL2   (R6)+,R5                 ;Add pagcnt to relative page offset
          EC 52  F5  0226              SOBGTR  R2,330$                  ;Go check if PFN is in next piece
                     0229              BUG_CHECK       SCANDEADPT       ;Error, PFN must be within this GSD
              FEFF   0229                      .WORD   ^XFEFF
             0000'   022B                      .IIF DIF <CONT>,<FATAL> , .WORD BUG$_SCANDEADPT
       50    76  C2  022D      350$:   SUBL2   -(R6),R0                 ;Get relative page within this piece
       50    55  C0  0230              ADDL2   R5,R0                    ;Add page counts of other pieces to off
     50   10 A1  C0  0233              ADDL2   SEC$L_VBN(R1),R0         ;Add in base VBN
        0050 8F  BA  0237              POPR    #^M<R4,R6>               ;Restore registers
     52   0C A1  D0  023B              MOVL    SEC$L_WINDOW(R1),R2      ;Get window address
            88   11  023F              BRB     310$                     ;Join common code
```

```
    0241           .SBTTL  PTEPFNMFY - Get PFN and Modify bit from PTE
    0241
    0241     ;+
    0241     ;
    0241     ; FUNCTIONAL DESCRIPTION:
    0241     ;
    0241     ;       Return PFN and modify bit if page is a candidate for write
    0241     ; back clustering.
    0241     ;
    0241     ; CALLING SEQUENCE:
    0241     ;
    0241     ;       BSBW    MMG$PTEPFNMFY
    0241     ;
    0241     ; INPUTS:
    0241     ;
    0241     ;       R0 = Access mode to check against page owner
    0241     ;       R1 = Exclusive writer indicator
    0241     ;       R2 = Process section backing store address or GPTX
    0241     ;          = 0 if supposed to return the above or shared memory global page
    0241     ;       R3 = System Virtual Address of Page Table Entry
    0241     ;       IPL = SYNCH
    0241     ;
    0241     ; OUTPUTS:
    0241     ;
    0241     ;       R0 = Page Frame Number if successful
    0241     ;       R1 = low bit clear if page is not a candidate for write back clustering
    0241     ;            non-zero if actual error, 0 if just not a candidate
    0241     ;          = low bit set if page could be cluster written
    0241     ;            bit 7 set if modified page
    0241     ;       R2 = Process section address if process page
    0241     ;          = GPTX if global page
    0241     ;       R3   preserved
    0241     ;
    0241     ;-
    0241     ;
    0241     ; ***********************************************************************
    0241     ;
    0241     ; **************** THE FOLLOWING CODE MUST BE RESIDENT *****************
    0241     ;
00000241           .PSECT  $MMGCOD
    0241     ;
    0241     ; ***********************************************************************
    0241     ;
```

```
                                    0241  913                .ENABL  LSB
                                    0241  914 ;
                                    0241  915 ; Pages with PFN's greater than MAXPFN must be in shared memory (or  PFN-mapped,
                                    0241  916 ; PTE$V_WINDOW set).  Shared memory pages are always mapped via global sections.
                                    0241  917 ; There is no PFN data base for shared memory global section pages.
                                    0241  918 ;
                                    0241  919 SHM_PAGE:
                      0053 8F   BB  0241  920           PUSHR    #^M<R0,R1,R4,R6>              ;Save registers
                           51   D4  0245  921           CLRL     R1                            ;Indicate no decrement to PTE ref count
                        FDB6'   30  0247  922           BSBW     MMG$FINDGSDPFN                ;Find SHMGSD for this PFN
                        25 50   E9  024A  923           BLBC     R0,30$                        ;Branch if none found (ERROR CONDITION)
               52 A6    15 A4   91  024D  924           CMPB     SHB$B_PORT(R4),GSD$B_CREATPORT(R6) ;Is process on creator port?
                           19   12  0252  925           BNEQ     20$                           ;Br if different port, cannot do update
                  52    16 A6   3C  0254  926           MOVZWL   GSD$W_GSTX(R6),R2             ;Get global section table index
                           50   D4  0258  927           CLRL     R0                            ;Assume page not a wrt candidate
               13 20 A6    03   E1  025A  928           BBC      #SEC$V_WRT,GSD$W_FLAGS(R6),30$ ;Br if section not writeable
                      0053 8F   BA  025F  929           POPR     #^M<R0,R1,R4,R6>              ;Restore registers
                     5E    04   C0  0263  930           ADDL2    #4,SP                         ;Clean off saved input backing store adr
                  00 52    16   E3  0266  931           BBCS     #PTE$V_TYP0,R2,10$            ;Treat section as a process section
                         008E   31  026A  932 10$:      BRW      100$                          ;in WRTPGSBAK routine
                50    0384 8F   3C  026D  933 20$:      MOVZWL   #SS$_NOTCREATOR,R0            ;Return error code
                  04 AE    50   D0  0272  934 30$:      MOVL     R0,4(SP)                      ;Insure that error code gets to R1
                      0053 8F   BA  0276  935           POPR     #^M<R0,R1,R4,R6>              ;Restore registers
                         00D8   31  027A  936           BRW      180$                          ;Page not candidate for update
                                    027D  937
                                    027D  938 MMG$PTEPFNMFY:
                           51   DD  027D  939           PUSHL    R1                            ;Save exclusive writer bit
                           52   DD  027F  940           PUSHL    R2                            ;and the input backing store address
         51    53    15    09   EF  0281  941           EXTZV    #VA$V_VPN,#VA$S_VPN,R3,R1 ;Check for presence of page table
                    0000'DF41   D5  0286  942           TSTL     @W^MMG$GL_SPTBASE[R1]         ;If SPT entry is not valid then
                           51   18  028B  943           BGEQ     70$                           ;this page table is not resident
         50    63    02    17   ED  028D  944           CMPZV    #PTE$V_OWN,#PTE$S_OWN,(R3),R0 ;Check for page owner violation
                           75   19  0292  945           BLSS     130$                          ;Branch if it is
      50    63    7B800000 8F   CB  0294  946           BICL3    #^C<PTE$M_VALID !-            ;Get valid bit
                                    029C  947                    PTE$M_TYPT ! PTE$M_TYP0 !- ;type bits
                                    029C  948                    PTE$M_PGFLVB>,(R3),R0         ;and PFN/GPTX from the PTE
                           72   18  029C  949           BGEQ     140$                          ;Branch if not valid
                  3C 50    15   E0  029E  950           BBS      #PTE$V_WINDOW,R0,70$          ;Branch if PFN-mapped
               51    50    0D   9C  02A2  951 40$:      ROTL     #<32-<PTE$V_MODIFY-PFN$V_MODIFY>>,R0,R1 ;R1<7> = Modify bit
         50    50    15    00   EF  02A6  952           EXTZV    #PTE$V_PFN,#PTE$S_PFN,R0,R0 ;Isolate PFN
            00000000'EF    50   D1  02AB  953           CMPL     R0,MMG$GL_MAXPFN              ;Is this a SH MEM page?
                           8D   1A  02B2  954           BGTRU    SHM_PAGE                      ;Br if it is a SH MEM page
              51    0000'DF40   88  02B4  955 50$:      BISB     @W^PFN$AB_STATE[R0],R1        ;Or in PFN copy of Modify bit
              52    0000'DF40   D0  02BA  956           MOVL     @W^PFN$AL_BAK[R0],R2          ;Backing store address to check
                                    02C0  957                                                  ;if page is not global
              0000'DF40    53   D1  02C0  958           CMPL     R3,@W^PFN$AL_PTE[R0]          ;If process PTE address is different
                           0D   13  02C6  959           BEQL     60$                           ;Branch if process page
   52    0000'DF40    0000'CF   C3  02C8  960           SUBL3    W^MMG$GL_GPTBASE,@W^PFN$AL_PTE[R0],R2 ;Offset from GPT base
               52    52    1E   9C  02D1  961           ROTL     #<32-2>,R2,R2                 ;Form Global Page Table Index
                           6E   D5  02D5  962 60$:      TSTL     (SP)                          ;Specified section or GPTX?
                           07   13  02D7  963           BEQL     80$                           ;Branch if not, return section or GPTX
                     6E    52   D1  02D9  964           CMPL     R2,(SP)                       ;Yes, check that this one matches
                           05   13  02DC  965           BEQL     90$                           ;Branch if it is
                           73   11  02DE  966 70$:      BRB      170$                          ;Not the same, end of cluster
                     6E    52   D0  02E0  967 80$:      MOVL     R2,(SP)                       ;Return the section or GPTX
              52    0000'DF40   D0  02E3  968 90$:      MOVL     @W^PFN$AL_BAK[R0],R2          ;Check that page is really writable
                  66 52    16   E1  02E9  969           BBC      #PTE$V_TYP0,R2,170$           ;making sure it is a section,
             62 52    12    E1  02ED             BBC     #PTE$V_WRT,R2,170$          ;that it is writable
             5E 52    10    E0  02F1             BBS     #PTE$V_CRF,R2,170$          ;and that it is not copy on reference
                      04    BA  02F5             POPR    #^M<R2>                     ;Fetch return section/GPTX
             07 52    16    E0  02F7             BBS     #PTE$V_TYPO,R2,110$         ;Branch if not a global page
                                02FB     ;
                                02FB     ; For the case of Global pages, the "complete" test for modified is not
                                02FB     ; possible since all process' which have valid PTE's for the global page
                                02FB     ; have their own copy of the modify bit.  This is only folded back into
                                02FB     ; the PFN data base when the page is removed from the process' working
                                02FB     ; set.  If the "exclusive write" flag is set, a Global page is only
                                02FB     ; considered modified if the process PTE or the PFN data base says that
                                02FB     ; the page is modified.  Otherwise, all Global Writable pages are considered
                                02FB     ; modified for the purposes of this write back logic.
                                02FB     ;
                   04 6E    E8  02FB     100$:   BLBS    (SP),110$                   ;Branch if exclusive writer
             51    80 8F    88  02FE             BISB    #PFN$M_MODIFY,R1            ;Force modify for global writable page
                51    01    C8  0302     110$:   BISL    #1,R1                       ;Indicate successful return
                5E    04    C0  0305     120$:   ADDL    #4,SP                       ;Clean off save exclusive writer bit
                      05        0308             RSB
                                0309     ;
                                0309     ; Page owner violation
                                0309     ;
          51    01EC 8F     3C  0309     130$:   MOVZWL  #SS$_PAGOWNVIO,R1           ;Return error status
                      45    11  030E             BRB     180$
                                0310     ;
                                0310     ; Page table entry was not valid, see if it is transition or global
                                0310     ;
                      41    13  0310     140$:   BEQL    170$                        ;Branch if demand zero, end of cluster
       51    50    EA 8F    78  0312             ASHL    #-PTE$V_TYPO,R0,R1          ;Transition page?
                      23    13  0317             BEQL    160$                        ;Branch if yes
                                0319     ;
                                0319     ; Process page table entry is not valid and not transition.
                                0319     ; See if it is global.
                                0319     ;
                51    01    91  0319             CMPB    #1,R1                       ;TYP1 = 0, TYPO = 1 ?
                      35    12  031C             BNEQ    170$                        ;Branch if not global
      50    50    16    00  EF  031E             EXTZV   #PTE$V_GPTX,#PTE$S_GPTX,R0,R0 ;Isolate GPTX
                            CB  0323             BICL3   #^C<PTE$M_VALID !-          ;Get valid bit
                                0324                     PTE$M_TYPT ! PTE$M_TYPO !- ;type bits
                                0324                     PTE$M_PGFLVB>,-             ;and PFN/GPTX
50    0000'DF40   7B800000 8F   0324                     @W^MMG$GL_GPTBASE[R0],R0 ;from the global PTE
                      05    14  032E             BGTR    150$                        ;Branch if not valid and not DZRO
                      21    13  0330             BEQL    170$                        ;Branch if demand zero to end cluster
                    FF6D    31  0332             BRW     40$                         ;Process valid master PTE
       51    50    EA 8F    78  0335     150$:   ASHL    #-PTE$V_TYPO,R0,R1          ;Check for transition state
                      17    12  033A             BNEQ    170$                        ;End of cluster if not
                                033C     ;
                                033C     ; This is a transition page.  If it is on the free or modified page list
                                033C     ; or in the RELPEND or ACTIVE state, then it is still a candidate.
                                033C     ;
                03    00    EE  033C     160$:   EXTV    #PFN$V_LOC,#PFN$S_LOC,- ;Get page location (-4 to 3)
          51   0000'DF40        033F                     @W^PFN$AB_STATE[R0],R1
                                0344
                                0344             ASSUME  PFN$C_RDERR      EQ 4       ;Page read error -4
                                0344             ASSUME  PFN$C_WRTINPROG  EQ 5       ;Write in progress -3
                                0344             ASSUME  PFN$C_RDINPROG   EQ 6       ;Read in progress -2
                                0344             ASSUME  PFN$C_ACTIVE     EQ 7       ;Active -1
                            0344           ASSUME  PFN$C_FREPAGLST EQ 0     ;On free page list
                            0344           ASSUME  PFN$C_MFYPAGLST EQ 1     ;On modified page list
                            0344           ASSUME  PFN$C_BADPAGLST EQ 2     ;On bad page list
                            0344           ASSUME  PFN$C_RELPEND   EQ 3     ;Release pending
                            0344
                            0344           CASE    R1,<-
                            0344                   200$,-                   ;-1 = active
                            0344                   200$,-                   ;0  = free page list
                            0344                   200$,-                   ;1  = modified page list
                            0344                   190$,-                   ;2  = bad page list
                            0344                   200$ -                   ;3  = release pending
                            0344                   >,TYPE=B,LIMIT=#-1
   04'  FF 8F   51   8F     0344           CASEB   R1,#-1,S^#<<30003$-30002$>/2>-1
                            0349   30002$:
                    0017'   0349           .SIGNED_WORD    200$-30002$
                    0017'   034B           .SIGNED_WORD    200$-30002$
                    0017'   034D           .SIGNED_WORD    200$-30002$
                    0010'   034F           .SIGNED_WORD    190$-30002$
                    0017'   0351           .SIGNED_WORD    200$-30002$
                            0353   30003$:
                            0353   ;
                            0353   ; This page is not part of the current cluster
                            0353   ;
                51   D4     0353   170$:   CLRL    R1                       ;Return error status
                04   BA     0355   180$:   POPR    #^M<R2>                  ;Clean off saved input backing store adr
                AC   11     0357           BRB     120$
                            0359   ;
                            0359   ; This page is on the bad page list, if it does not have the "bad" bit
                            0359   ; set, then the page was placed there by the modified page writer due to
                            0359   ; a write error.  In this case the page should be a candidate for write back.
                            0359   ;
F3 0000'DF40    05   E0     0359   190$:   BBS     #PFN$V_BADPAG,@W^PFN$AB_TYPE[R0],170$ ;End cluster if bad bit set
                            0360   ;
                            0360   ; This page is resident and has no I/O pending.  It may be clustered.
                            0360   ;
                51   D4     0360   200$:   CLRL    R1                       ;No modify bit from PTE
              FF4F   31     0362           BRW     50$
                            0365
                            0365           .DSABL  LSB
                            0365
                            0365           .END
```

```
ACB$M_QUOTA       = 00000040              MMG$CREDEL          ********     X  02
ACB$V_QUOTA       = 00000006              MMG$C_LENGTH      = FFFFFFE4
ACMODE            = 0000000C              MMG$FINDGSDPFN      ********     X  03
ASTADR            = 0000001C              MMG$FINDSHD         ********     X  03
ASTPRM            = 00000020              MMG$GL_GPTBASE      ********     X  03
BAK                 00000030              MMG$GL_MAXPFN       ********     X  03
BUG$_SCANDEADPT     ********     X  03    MMG$GL_SPTBASE      ********     X  03
BUG$_WRTPGSBAK      ********     X  03    MMG$GL_SYSPHD       ********     X  03
CA$_MEASURE       = 00000002              MMG$INADRINI        ********     X  02
CLUSTER             00000018              MMG$INIBLDPKT       ********     X  03
COUNT               0000001C              MMG$L_MAXACMODE   = FFFFFFFC
CTL$GL_PHD          ********     X  02    MMG$L_SAVRETADR   = FFFFFFF4
DIR...            = 00000001              MMG$L_SVSTARTVA   = FFFFFFEC
DYN$C_IRP         = 0000000A              MMG$PTEINDX         ********     X  03
EFN               = 00000014              MMG$PTEPFNMFY       0000027D R      03
EXCLWRT             00000020              MMG$REMPFN          ********     X  03
EXE$ALLOCBUF        ********     X  02    MMG$RETRANGE        ********     X  02
EXE$BUILDPKTW       ********     X  03    MMG$UPDSECAST       00000116 RG     02
EXE$DEANONPAGED     ********     X  02    MMG$UPDSECPAG       000000E9 R      02
EXE$SNGLEQUOTA      ********     X  02    MMG$UPDSECQWT       00000000 R      03
EXE$UPDSEC          00000001 RG     02    MMG$WRTPGSBAK       0000006D RG     03
FLAGS             = 00000010              MPW$GW_MPWPFC       ********     X  03
GSD$B_CREATPORT   = 00000052              PCB$B_PRIB        = 0000002F
GSD$C_PFNBASMAX   = 00000004              PCB$L_PHD         = 0000006C
GSD$L_BASPFN1     = 00000054              PCB$L_PID         = 00000060
GSD$W_FLAGS       = 00000020              PCB$W_ASTCNT      = 00000038
GSD$W_GSTX        = 00000016              PCB$W_DIOCNT      = 0000003E
INADR             = 00000004              PFN$AB_STATE        ********     X  03
INADRERR            00000000 R      02    PFN$AB_TYPE         ********     X  03
INC1                00000028              PFN$AL_BAK          ********     X  03
INC4                0000002C              PFN$AL_PTE          ********     X  03
IOC$DIRPOST1        ********     X  02    PFN$AW_REFCNT       ********     X  03
IOSB              = 00000018              PFN$C_ACTIVE      = 00000007
IPL$_SYNCH        = 00000008              PFN$C_BADPAGLST   = 00000002
IRP$B_EFN         = 00000022              PFN$C_FREPAGLST   = 00000000
IRP$B_PRI         = 00000023              PFN$C_MFYPAGLST   = 00000001
IRP$B_RMOD        = 0000000B              PFN$C_RDERR       = 00000004
IRP$B_TYPE        = 0000000A              PFN$C_RDINPROG    = 00000006
IRP$C_LENGTH      = 000000C4              PFN$C_RELPEND     = 00000003
IRP$L_AST         = 00000010              PFN$C_WRTINPROG   = 00000005
IRP$L_ASTPRM      = 00000014              PFN$M_MODIFY      = 00000080
IRP$L_IOSB        = 00000024              PFN$S_LOC         = 00000003
IRP$L_IOST1       = 00000038              PFN$V_BADPAG      = 00000005
IRP$L_IOST2       = 0000003C              PFN$V_LOC         = 00000000
IRP$L_PID         = 0000000C              PFN$V_MODIFY      = 00000007
IRP$L_SEGVBN      = 00000048              PHD$L_PSTBASOFF   = 00000020
IRP$W_SIZE        = 00000008              PMS$GL_PWRITES      ********     X  03
IRP_AST             00000010              PMS$GL_PWRITIO      ********     X  03
IRP_ASTPRM          00000014              PR$_IPL           = 00000012
IRP_EFN             00000022              PR$_TBIS          = 0000003A
IRP_IOSB            00000024              PRI$_IOCOM        = 00000001
IRP_IOST1           00000038              PROCPTE             00000040
IRP_LENGTH          0000004C              PSL$S_PRVMOD      = 00000002
IRP_PRI             00000023              PSL$V_PRVMOD      = 00000016
IRP_RMOD            0000000B              PTE$M_MODIFY      = 04000000
IRP_SEGVBN          00000048              PTE$M_PGFLVB      = 003FFFFF
MFYCNT              0000000C              PTE$M_TYP0        = 00400000
```

```
PTE$M_TYP1                       = 04000000
PTE$M_VALID                      = 80000000
PTE$S_GPTX                       = 00000016
PTE$S_OWN                        = 00000002
PTE$S_PFN                        = 00000015
PTE$V_CRF                        = 00000010
PTE$V_GPTX                       = 00000000
PTE$V_MODIFY                     = 0000001A
PTE$V_OWN                        = 00000017
PTE$V_PFN                        = 00000000
PTE$V_TYP0                       = 00000016
PTE$V_WINDOW                     = 00000015
PTE$V_WRT                        = 00000012
PTEDAT                             00000004
RETADR                           = 00000008
SAVABS...                        = 000000D4
SCH$CLREF                          ********      X     02
SCH$POSTEF                         ********      X     02
SEC$L_GSD                        = 00000000
SEC$L_VBN                        = 00000010
SEC$L_WINDOW                     = 0000000C
SEC$V_WRT                        = 00000003
SHB$B_PORT                       = 00000015
SHB$L_BASGSPFN                   = 00000010
SHM_PAGE                           00000241 R          03
SS$_ACCVIO                       = 0000000C
SS$_EXQUOTA                      = 0000001C
SS$_IVSECFLG                     = 0000016C
SS$_NORMAL                       = 00000001
SS$_NOTCREATOR                   = 00000384
SS$_NOTMODIFIED                  = 00000659
SS$_PAGOWNVIO                    = 000001EC
SVAPTE                             00000000
VA$S_VPN                         = 00000015
VA$V_VPN                         = 00000009
XIP_B_MAXACMODE                    000000D1
XIP_B_UPDFLG                       000000D0
XIP_C_LENGTH                       000000D4
XIP_L_DIREC                        000000C8
XIP_L_SCANCNT                      000000C4
XIP_L_STARTVA                      000000CC

                                                  +----------------+
                                                  ! Psect synopsis !
                                                  +----------------+

PSECT name                       Allocation          PSECT No.  Attributes
----------                       ----------          ---------  ----------
.  ABS  .                        00000000  (    0.)  00 (  0.)  NOPIC   USR   CON   ABS   LCL NOSHR NOEXE NORD  NOWRT NOVEC BYTE
$ABS$                            000000D4  (  212.)  01 (  1.)  NOPIC   USR   CON   ABS   LCL NOSHR   EXE   RD    WRT NOVEC BYTE
Y$EXEPAGED                       00000189  (  393.)  02 (  2.)  NOPIC   USR   CON   REL   LCL NOSHR   EXE   RD    WRT NOVEC BYTE
$MMGCOD                          00000365  (  869.)  03 (  3.)  NOPIC   USR   CON   REL   LCL NOSHR   EXE   RD    WRT NOVEC BYTE
```

```
                                  +--------------------------+
                                  ! Performance indicators !
                                  +--------------------------+

Phase                     Page faults   CPU Time       Elapsed Time
-----                     -----------   --------       ------------
Initialization                     31   00:00:00.07    00:00:00.26
Command processing                107   00:00:00.56    00:00:01.06
Pass 1                            430   00:00:15.58    00:00:18.15
Symbol table sort                   0   00:00:02.32    00:00:02.41
Pass 2                            207   00:00:03.69    00:00:04.11
Symbol table output                19   00:00:00.15    00:00:00.15
Psect synopsis output               1   00:00:00.02    00:00:00.02
Cross-reference output              0   00:00:00.00    00:00:00.00
Assembler run totals              797   00:00:22.39    00:00:26.16

The working set limit was 1650 pages.
94749 bytes (186 pages) of virtual memory were used to buffer the intermediate code.
There were 80 pages of symbol table space allocated to hold 1436 non-local and 73 local symbols.
1059 source lines were read in Pass 1, producing 23 object records in Pass 2.
36 pages of virtual memory were used to define 34 macros.

                                 +----------------------------+
                                 ! Macro library statistics !
                                 +----------------------------+

Macro library name                         Macros defined
------------------                         --------------
_$255$DUA28:[SYS.OBJ]LIB.MLB;1                        21
_$255$DUA28:[SYSLIB]STARLET.MLB;2                     10
TOTALS (all libraries)                                31

1596 GETS were required to define 31 macros.

There were no errors, warnings or information messages.

MACRO/LIS=LIS$:SYSUPDSEC/OBJ=OBJ$:SYSUPDSEC MSRC$:SYSUPDSEC/UPDATE=(ENH$:SYSUPDSEC)+EXECML$/LIB
```

0388 AH-BT13A-SE
VAX/VMS V4.0

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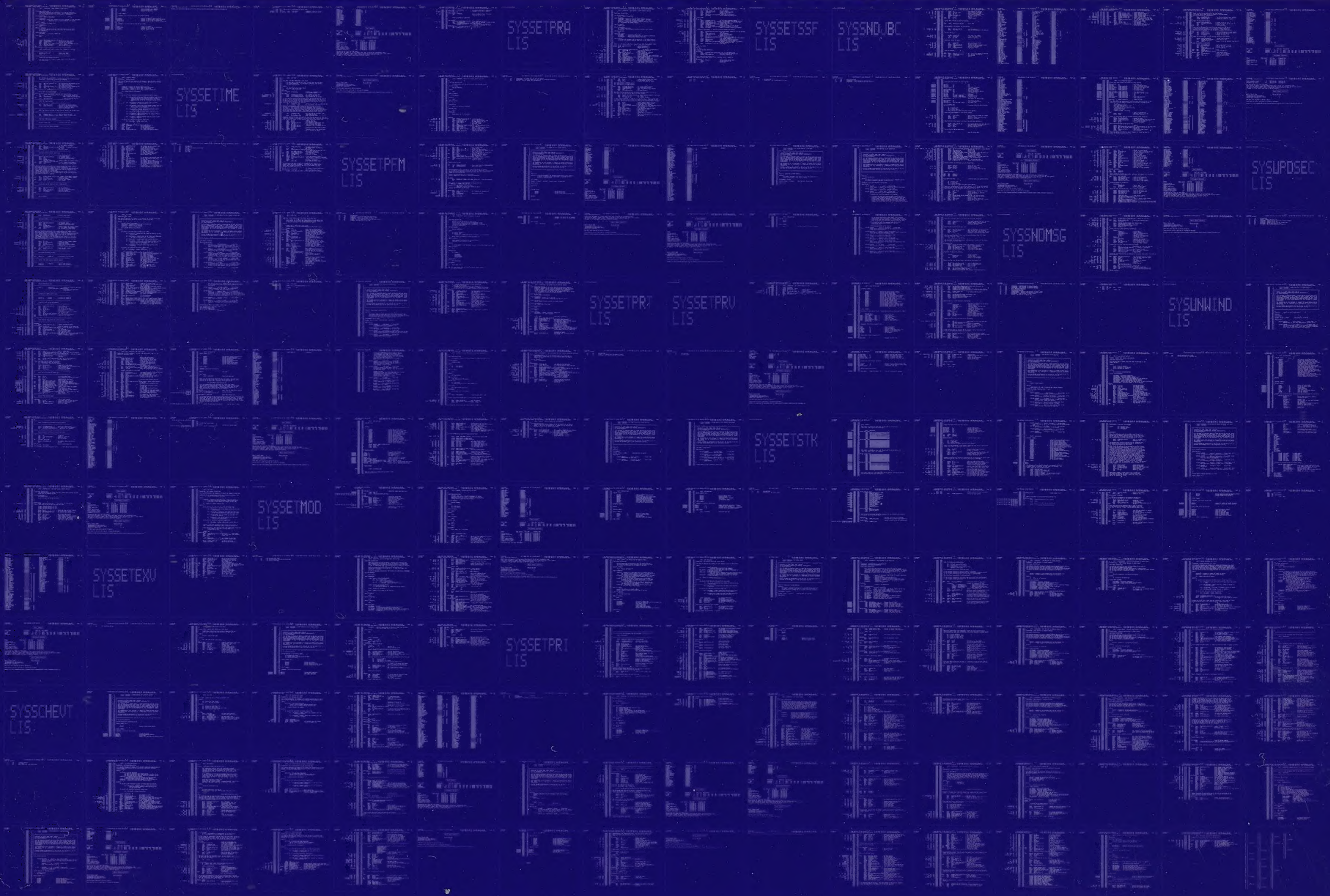

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